The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Plant Accessories

IT is an old saying that clothes make the man, an expression embodying the truth that although the essential qualities reside in the man himself his success or failure as a member of a civilised community depends very largely upon the accessories with which he is equipped. The subject of plant accessories, which is the special feature of this issue of THE CHEMICAL AGE, can never be far from the thoughts of the chemical engineer. It is an arguable point as to what are accessories and what are fundamentals. The word "accessory" is defined in the dictionary as "something subordinate but contributing to the principal cause producing a general result." From the engineering angle it is defined as "additional details of equipment which, though indispensable, are not part of the original structure."

An accessory frequently has to withstand more exacting conditions of usage than does the plant to which it is attached. A vessel in which chemical reactions are carried out may comprise the plant proper. It may be subjected to corrosive influences, to heat or to pressure, but these conditions can be adequately taken care of by the design of the vessel or by the nature and thickness of the metal employed. There is often a limitation, however, to the materials and thickness used for accessories, and they are, moreover, often moving parts and thus subject to special wear and tear. There is thus every justification for spending money on securing the best type and quality of accessory for a particular job. A great deal of waste, for example, can occur from leaking or unsatisfactory cocks and valves. These are properly called accessories because although they are indispensable parts of the apparatus proper, yet they are usually made by specialists and are bought by the plant maker.

Among the great mass of plant accessories an important place is occupied by instruments. These instruments contribute nothing to the plant itself, but are indispensable for working it under the correct conditions. The measurement of temperature and pressure are perhaps the most general control operations for all types of chemical processes. Industrial temperatures seldom require the very high degree of precision needed in the research department, but the apparatus used must be both robust and trustworthy, and it must be sufficiently accurate for whatever purpose it is needed. How often are works thermometers tested? We remember seeing many works thermometers, even including thermo-couple installations, that once installed seem to have been forgotten until the time has arrived when their readings have been so obviously incorrect as to become evident to the workmen operating the plant. The works chemist should be required to test all works instruments at least once a year. It is, however, a tribute to the robustness of manufacture of works temperature-measuring instruments that until they are actually broken their indications are pretty sound.

Both thermometers and pressure instruments must be correctly installed if their indications are to be of value. Quite often it is considered enough to determine the temperature of a gas in a main by inserting a thermometer an inch or two into a large main perhaps a foot or more in diameter, and leaving the instrument to be read periodically as required. In practice this may not matter because it may not be so important to obtain an absolutely correct temperature indication within a degree or so as to determine variations from the usual reading. The effect of radiation from the cooler sides of a pipe may, however, be considerable, and the positioning and selection of temperature-measuring instruments that will give a proper indication of the real state of affairs should be a matter for expert advice. In the same way a pressure instrument in the wrong position can give misleading indications, particularly where there is a stream of gases flowing with some velocity. The principle of the Pitot tube illustrates this fact.

The measurement of solids, liquids, and gases is another important outlet for plant accessories. There are many works in which comparatively few measurements are taken. The raw materials entering the works are paid for and thus are weighed or measured. The finished products leaving the works are sold and thus are likewise weighed. Between the entry and the exit no quantity measurements may be taken. Any works manager will admit that knowledge of the quantities with which he is dealing would be of inestimable value if it could be obtained. Quite frequently, however, the provision of satisfactory means may call for no little ingenuity. Generally, the measurement of solids is more difficult and expensive than that of liquids and gases, but the accuracy obtained may be greater. A direct weighing machine is usually the only means of measuring solids, though weighing machines can be operated in conjunction with moving belts to give a continuous record of the weight of materials entering or leaving an apparatus. Among other aids to plant control is the provision of *p*H meters to indicate the alkalinity or acidity of waters and of solutions. The provision of automatic apparatus for gas analysis, too, will indicate not only the progress of combustion in a furnace, but also the progress of a chemical reaction from which a particular gas is evolved, the quantity of which in the exit gases will serve as a measure of the rate of reaction.

CONTENTS

NOTES AND COMMENTS

Wanted : A Heat Flow Meter

ONE of the chemical plant accessories which has not been invented so far as we are aware and for which there is real need is a simple method of determining the flow of heat. We can measure the flow of electricity, the intensity of light, the flow of fluids and even of solids, but to obtain some positive indication of the amount of heat which is escaping through a wall, for example, or from an open furnace door, is a considerable undertaking and involves a highly technical investigation. It is possible, of course, to measure the surface temperatures, to compute the probable loss of heat from those figures, but failing that it is necessary to take out a full heat balance. Undoubtedly measurements of heat flow presents considerable difficulties which do not at the moment appear capable of solution

Labour Supply for the Chemical Industries

THE application of the Essential Work Order to the chemical industry is now in full swing, and the Chairman of the Chemical Control Board is circularising the firms that are being scheduled under the Chemical Labour Supply Scheme depending on the Essential Work Order. Special consideration has been and is being given to the supply of labour in so important and multifarious a branch of industry as is the chemical industry, and the problem of this labour supply is not the least complicated of the many questions that have to be faced by the Ministry of Supply. The object of the present scheme is to maintain the trained labour force of the industry and to ensure that the available man-power is used to the best effect in the work which the industry is already called upon to undertake in the national interest and in the greater efforts that are likely to be called for in the future. To attain this end the support of all employers in the industry is essential and Mr. Bain, Chairman of the Chemical Control Board, hopes that the good start already made with the scheme will continue to full fruition. In his circular communication it is stated that the production of some parts of the industry has to be increased; in some cases additional workers will be required, but in others the necessary increase of production may be possible by suitable rearrangements and without increased labour. In other sections of the industry production may have to be curtailed and workers will become redundant. Further, in order to ensure the most economical use both of man-power and plant a special Labour Supply Organisation has to be set up. The undertakings scheduled to be thus dealt with will be concerned with: (1) Heavy chemicals including acids, alkalies, salt, and other heavy chemicals including inorganic pigments; (2) fine chemicals including medicinal, laboratory, photographic and rare earths; (3) industrial alcohols, acetone, and their derivatives; (4) fertilisers; (5) explosives; (6) dyestuffs and their intermediates, including organic pigments; (7) coal-tar distillation products; (8) plastics, resins and plasticisers; (9) gelatines, glues and sizes; (10) chemicals and extracts for tanning. A list of the Chemical Labour Supply Committees, with Employers' and Workers' Representatives, has been sent to all firms on the schedule.

Problems for the Agricultural Chemist

TRIBUTE to the work done by the chemist on behalf of agriculture has been paid by Sir John Russell, Director of the Rothamsted Experimental Station. None is more qualified than he to speak of the progress of scientific agriculture and we propose on a future occasion to make further comment on the main thesis of a masterly paper on "The Chemist in Agriculture," which he read earlier this year to a meeting of the Society of Chemical Industry and which has now been published. This week it will be of interest to take note of some of the remarks that he made in his concluding paragraphs, which were concerned more with what remains for the chemist to do in this field. Chemical control of pests has already performed invaluable services; but the work is so far largely empirical. We know that our "indefinite mixtures" of toxic products—derris, pyrethrum, and so on—do the trick, but we don't altogether know why. Artificial preparation of such products on a factory scale is a desideratum, and the problem involved is by no means a simple one, because the desirable toxicity is not merely due to the alkaloid present, but is enhanced by certain resins or other compounds. A really satisfying killer for wireworms has yet to be discovered, too; although great chemical interests have financed the search for five years the problem still stands over for future research. Weed-killers and their application are likewise worthy of further study. Copper sulphate, finely-powdered cyanamide, and sulphuric acid are all effective, but a plentiful supply in war-time is by no means certain, and a substitute would be welcome. An obvious danger with every new weed-killer is that it may do as much harm to the crop as to the weeds. Upstanding crops, such as corn crops, naturally are less liable to this danger as their smooth upright leaves afford no foothold for a solution; but a clover crop, for instance, is a very different matter, and presents yet another tricky problem.

Science and the B.B.C.

WRITING from Cambridge to the *Manchester Guardian*, Mr. Kenneth M. Smith calls timely attention to the lack of official publicity given to the lives and works of scientists. We are repeatedly told, he points out, the life-stories of "Miss Glamour" or "Mr. Crooner," but how often, he asks, do we hear the history of men like Pasteur, Jenner, or Ronald Ross. A series of such life-stories would be specially appropriate nowadays, when the work of scientists has been perverted by criminals to wreak destruction on mankind and civilisation; and the wealth of available material is enormous. Anyone who has taken the slightest interest in chemical history will have been struck by the romantic lives of the great chemists, whether theoretical or industrial, and the vast amount of varied incident surrounding their work. The all-too-brief life of Moseley, for example, ending on the arid hillside of Gallipoli, would serve as a pertinent warning against the misuse of scientific genius. The enthusiasm of Perkin, the downrightness of Armstrong—many other such instances could be cited among modern British chemists alone. And, now of all times, there would be no need for rigid nationalism; there would be little harm in reminding the Germans that they once produced scientists who worked for the benefit of mankind, not merely for the glorification of the *Herrenvolk*.

VALVES AND COCKS FOR CHEMICAL PLANT

Fundamental Types and Refinements

by C. H. BUTCHER

VALVES and cocks are essential to the operation of all chemical plant where fluids are handled, whether as liquids or solutions, gases or vapours. Without them, in one fom or another, it would be impossible to control or arrest the flow of a fluid through a pipe, or to provide easy means for drawing off liquid or solution from one vessel to another. To meet different situations and conditions of use, the makers of valves have introduced many variations in construction, as well as refinements for ease of operation. There is no single pattern which meets all cases where a valve or cock is needed, for apart from precise use and situation upon the plant there are conditions of working temperature, pressure, nature of fluid, and other matters which arise as final deciding points. Every need for a valve or cock carries certain precise requirements, which must be taken into consideration if the pattern ultimately installed is to operate efficiently, giving good length of life and the minimum of attention in maintenance. Moreover, the operation of valves and cocks is not just the simple matter of opening and closing them; as plant accessory features they all demand a certain respect in use, without which they cannot be expected to give good and trouble-free service.

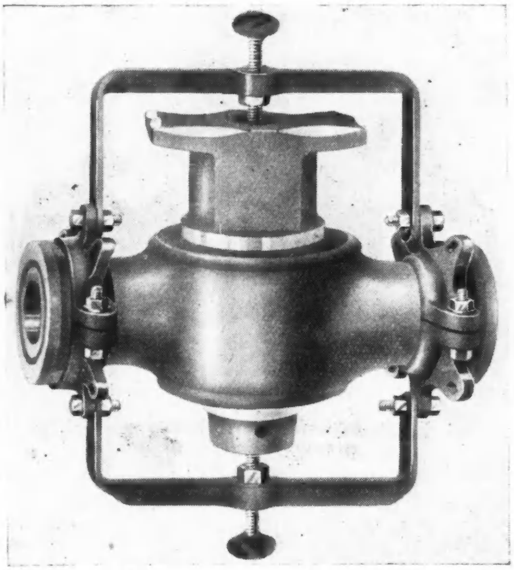
The materials used for valve making have to be selected to suit the nature and concentration of the fluid which is to be handled, if that fluid has any particular characteristics; there is also its temperature, its pressure, its degree of cleanliness or extent to which gritty suspensions are present in a liquid or dust in a gas, as well as the maximum velocity at which the fluid may pass through the valve when it is in service. This last-mentioned factor may be important from point of view of erosion or the wearing away of the interior of the valve, especially the essential parts for valve action. Internal erosion as well as corrosion will sooner or later develop troubles apart from interior leakage or failure to close tightly. The fundamental valve types, however, are comparatively few; it is in the details of construction and refinements of operation that the subject of valve design becomes specialised.

The gate valve has a sliding member or " gate " which is moved at right angles to the flow of the fluid to stop it. In globe valves and needle valves there is a plug of different form which is really pushed into an opening in the pipe through which the fluid is passing. Plug valves, better and commonly called cocks, have a plug with a hole or passage-way through it, and the flow of the fluid is reduced or completely stopped according to the extent to which this plug is turned about its vertical axis in a conical seating. In another fundamental type there is flexible material internally, which can be pressed down upon a rigid seat or pinched between two rigid faces to close the valve against the passage of fluid. Additionally, there are valves of the seatless pattern with a sliding piston, butterfly valves with a rotating damper, and others that use a liquid seal against the flow of a gas or vapour.

Selection of Materials

In these fundamental types almost every available material of construction which can be cast or moulded has been employed, provided that material can be ultimately machined or ground to precise dimensions and shape, is strong enough to give good service, and has good resistance against corrosion and erosion. Where a particular material may be desirable in one respect, such as corrosion resistance, and yet unsuitable for the body of the valve in mechanical strength, it is still possible to use it as an internal lining, as in the case of a valve where the interior of the body is lined with hard rubber and there is a rotating plug of the same material. Metal linings, such as chemical quality lead, can be used if the desired metal is too soft to permit of it being used entirely for the construction of the valve. Both glass and chemical stoneware are employed, for both of these materials can be ground to give a gas or liquid tight fit between a rotating conical plug and its seating as part of the body of the valve.

Acid-proof stoneware cocks are used especially as a means of regulating the flow of corrosive fluids. The material is proof against all corrosive chemicals except hydrofluoric acid and hot strong caustic alkalies. They are capable of withstanding high pressures and are subjected to severe tests before despatch from the makers.

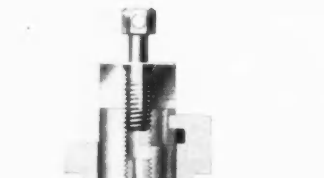


Conical flanged stoneware acid cock, with metal fittings and safety devices, by Doulton & Co., Ltd.

Three different finishes are available; brown salt glazed, cream glazed and—for special purposes—white glazed. These last are made from a special body which combines the outstanding qualities of stoneware and porcelain with unusual mechanical strength. Where conditions require a high degree of safety, metal fittings can be incorporated which are operated either to hold the key firmly in the body or to lift the plug slightly, to enable it to be moved freely. For use in metal pipe lines or where pressures of a higher order are involved, a particularly robust form of block cock is made and special armoured cocks are available for very severe conditions of temperature and pressure. For the majority of purposes, ordinary designs of stoneware taps are satisfactory, but under certain conditions there is a tendency for the plug to stick. A tap, known as the " Deuton " tap, which entirely overcame this difficulty was put on the market by a German firm and a certain number was sold in this country before the war. This question is now being studied by a British chemical stoneware maker and it is hoped that before long a range of these free-action taps will be available.

As already pointed out in brief, the gate valve functions by moving a sliding member or gate at right angles to cut the path of the fluid passing through the valve. This gate is guided by a slot in the body of the valve, on each side of which there is a replaceable ring-shaped seat with which the gate makes good contact, either because of the correspondence of its form with that of the seat, or by a particular construction in which the gate is in two halves (double disc) between which there is pressure from a

spring actuated by the operating mechanism of the valve. Expressed otherwise, there are two distinct principles of operation for gate valves. In one, the gate is a solid and slightly tapered wedge, which is forced by screw pressure into contact with the seat in the body of the valve. In the other, the gate is in the form of two discs, connected "concertina-fashion," which are lowered into the passage-way with its seats and there forced apart by pressure of an interior spring or other similar mechanism. Here there are two distinct movements which take their sequence in operation according to whether the valve is being opened or closed. In closing, the gate is lowered into the seating and then the interior pressure is exerted to make fluid-tight contact; for opening, the pressure is first released and



Patent plug-lubricated valve, produced by Audley Engineering Co., Ltd.

then the gate is raised out of the seating to give free passage for the fluid. Sometimes the valve operates merely by the interior pressure in the double disc gate, and there is no vertical movement. Refinements include quick opening types, and different methods of internal lubrication to reduce corrosion at the face of the seat and to make operation easier under certain conditions of use. Although gate valves are obtainable for pipes of 1 in. diameter upwards, the principle of such valves is more generally applied to pipes of large diameter.

In its simplest form (I) the operating spindle of the gate valve is connected in pivotal manner with the gate and slides and turns in a gland or stuffing box, and there is an internal screw thread controlling lengthwise motion. In another type (II) the operating spindle merely turns, but does not slide in the stuffing box, and there is a screw thread at the lower end by means of which the gate is caused to move up and down according to the direction of turning; this type of spindle is preferable where it is desired to avoid all possible atmospheric contamination of the fluid passing through the valve. A third mode of operation (III), really a modification of the first, has a spindle which slides and turns in the stuffing box, but the screw thread is outside the stuffing box with a hand-wheel held in place by a yoke. Types I and III are rising spindle gate valves; type II is a non-rising spindle pattern.

Gate valves of ordinary construction have a common drawback where a liquid has suspended solids or crystals in it, although such valves may be operated under these conditions with the gate and its spindle in a horizontal position instead of a vertical position. In the vertical position, the groove at the bottom of the body of the valve will fill with solids and so make the operation of the valve difficult or even impossible; alternatively, if the valve is turned over completely so that the spindle points downwards, it is easy for the bonnet or upper part of the valve body to fill with solids and likewise prevent operation. If it is impossible to use the valve in horizontal position the trouble has to be overcome by connecting an air or liquor pressure pipe, ⅛ in. bore, to the body of the valve in such a position that any collection of solids can be blown out or flushed from the groove as often as may be necessary in order to close the valve by the hand-wheel.

Under high pressure or at partial vacuum the gate valve can also be troublesome to operate, since the force against the valve being sufficient to make the task of opening and closing a hard one. In these circumstances it is necessary to provide for a by-pass, fitted with a small globe valve which can be opened to relieve the pressure, as a preliminary measure in moving the gate. To meet this need it is usual for such a by-pass to be incorporated into the design of the valve, especially with gate valves for pipes of large diameter. Under conditions of high pressure it is also possible to adopt a gate valve with an expanding double disc gate as distinct from a solid sliding gate.

Gate valves of the quick-opening type have a lever in place of a hand-wheel, and the gate is rotated between parallel faces in the body of the valve. In the butterfly valve the gate is rotated about its vertical axis to permit or impede the flow of fluid; such valves do not give a tight closure, but offer good service in merely controlling the flow of gases or vapours.

Cocks, or valves with plugs, were used long before any other type of valve, the most primitive form being that of a tap for an ale cask. Their prime disadvantage was that of sticking or seizing, coupled with a tendency to leak, outwardly as well as internally. The trouble of sticking has been overcome in modern plug cocks by pressure lubrication for the plug. Excellent resistance against corrosion is afforded by the fact that the machined surfaces which are in contact with a corrosive fluid are not the same surfaces that cut off the flow. Adopting a roughly rectangular or oval opening in the plug instead of a circular one, there is little or no tendency to create an eddy or disturbance in the flow of fluid when the cock is opened and closed by the lever handle at the top of the plug spindle. With a lubricated cock the tapered plug is held securely in place for perfect liquid tightness and yet easy movement is offered in the matter of turning the plug. If any unforeseen conditions do cause the plug to stick, it is possible to force in the lubricant under pressure and so loosen the plug.

The plug cock is made in all types of material, including acid-proof chemical stoneware, so that it can be adopted wherever corrosive liquids are in use. Its principle of construction makes it possible to interconnect two or more different pipelines; these "multi-way" cocks have the plug suitably passaged and are operated by lever handle in accord with outward indication of what is and what is not in connection. It is possible to use such a cock as a tee-piece between three pipelines, any two of which can be connected.

Fine Regulation

Resistance to fluid flow in plug cocks, generally, is much lower than for other types of valves, thanks to the preferred form of the passage-way in the plug. Cocks also have another advantage in that solids cannot easily deposit and hinder the flow or the operation of the cock. By use of a long lever it is possible to regulate rates of flow to very fine limits, equal and often better than those obtained in the case of a valve operated by a hand-wheel, especially when the cock is one of the lubricated plug type. With a graduated quadrant, provided with stops or peg holes, over which the lever is caused to move, it is easy to set the cock at any predetermined positions for definite rates of flow under known constant pressures. If necessary, positive seating and unseating can be provided mechanically by means of a lifting lever, which is used before and after that lever handle which turns the plug.

Globe valves function in principle by plugging a hole in the body of the valve, which is really a hole in the pipeline. Constructional details show wide variety, but all such valves are characterised by a shape of body in which there is abrupt change of direction of flow for the

fluid. Variations are chiefly a matter of the type of closure adopted for the seating, which is in a plane parallel with the flow of fluid. In one example a cone-shaped closure is pushed into the seat of the valve by means of a rotating spindle with a hand-wheel. In another, a disc of some flexible or resilient material is pressed tightly on the seat; this disc may be guided to and from the seat in the valve body, or may float freely in the fluid passing through the valve, as with globe valves of small bore. The common disc type of globe valve, however, is not very satisfactory for efficient throttling, especially with a liquid containing solids in suspension. To give full passage-way, or complete closing, at will, it is best to use a gate valve rather than any other type; for throttling, a cock of the best pattern is preferable to anything else. Neither are globe valves satisfactory on piping of large diameter, as there is a heavy total pressure on the disc, making it difficult to keep the disc tight upon its seat.

Modified Form of Globe Valve

The so-called Y-type valve is a modified pattern of the globe valve. It gives a nearly straight line of flow, as distinct from one which changes abruptly. It also has the advantage of easy accessibility to the seat for replacement of the disc, or regrinding. Needle valves are used chiefly for regulating the flow of a clean fluid, such as gas from a cylinder, regulation being possible to the highest degree. In these valves the end of the spindle has a fine cone-like point, but there are special refinements in construction.

Where valves are used on chemical plant the most universally desirable feature, apart from liquid or gas tightness and ease of operation, is the faculty of being able to repack the gland or stuffing box under pressure. In the case of globe valves it must be easy to replace the disc when necessity arises; likewise, it must be easy for the seat to be reground.

In gate valves there may be exclusive features embodied in the design, to ensure clean seats of corrosion-resisting material, positive closure, and trouble-free operation. For instance, the gate may be recessed so that it is out of contact with the seat except at a trailing edge, which remains in contact with the seat surface and wipes that surface when the gate is being lifted. Alternatively, there may be an actual seating disc in the gate, which is lifted away from its seat by a slight movement of the valve spindle towards the open position; this movement partially equalises the pressure on both sides and reduces friction to a minimum in lifting the gate.

Valves for Corrosive Liquids

Certain refinements have been incorporated in the valves used for handling corrosive liquids, in order to give trouble-free service. Spindle-screw threads are placed outside the body where they cannot be affected by the liquids in the pipeline. Constant contact area and tight closure is attained by a bevel-type disc face which parallels and equals the seat surface. A deeply scalloped hand-wheel design affords a perfect grip for greasy hands; moreover, if the structure of the hand-wheel is well perforated instead of solid this makes for a non-heating feature. The yoke bonnet, cast as one unit, gives free access to the gland flange and packing; it is easily removed for maintenance and cleaning, by loosening two clipped head bolts. Means are also adopted to prevent the gasket from blowing out when the yoke bonnet is removed. These are only a few points taken at random from the details of construction supplied by one maker of stainless steel Y-type valves for special corrosive liquid service.

In gate valves, irrespective of their type, there may be an unusually heavy body and bonnet construction, more powerful threads on the spindle, a sturdy bonnet collar, and extra deep stuffing box, all of which combine to guard against failure under severe conditions of service. In plug cocks there may be a refinement of packing the gland, which in addition to giving a tight seal also minimises friction and provides a cushion to absorb any expansion difference between plug and body. In globe valves, accurate disc guiding means accurate seating; therefore some disc holders have long guides which are always in contact with the body neck of the valve, and the holder carries the disc straight and true to its seat. Excessive spindle wear may be counteracted by use of a new spindle material; a hexagon head to the gland may avoid the necessity for prying a gland from its stuffing box; yet another refinement may prevent the disc holder from dropping off the spindle when the valve is being dismantled.

Formaldehyde Plant

Suitable Materials for Pipe-lines

In view of the fact that formaldehyde has been in growing demand for some years past, the review of the commercially-employed formaldehyde solutions presented by H. W. Homer in *J.S.C.I.*, 1941, *60*, 8, 213-218, is particularly important. Methods of testing, including a simplified system for determination of methyl alcohol in formalin, are explained, and a general outline of manufacture is given. Especially apposite to the present issue of The Chemical Age are the details of suitable material for the manufacture of the requisite plant, some details of which we reprint herewith.

The modern formalin plant is comparatively simple in general arrangement and the chemical engineering problems are mostly concerned with corrosion. Formaldehyde itself is chemically very active, but most of the corrosion is caused by traces of formic acid which are always present. Modern specifications demand that heavy metal contamination should be reduced to a minimum and it is usual to expect less than 5 parts per million of copper and 3 parts per million of iron. It is therefore impracticable to use iron, copper, or lead for vessels and plant in contact with formaldehyde although copper can be employed successfully if tinned (*i.e.*, hot-tinned, not sprayed). Moreover copper even when untreated is not attacked if the solution is maintained above 70°, at which temperature the reducing action of the formaldehyde is such that any dissolved metal is precipitated. Stainless irons and steels withstand formaldehyde in the cold satisfactorily. Aluminium is used for both plant and storage or transport vessels but is not free from attack, which rapidly takes the form of deep pitting in ordinary commercial grades. Only the purest obtainable (99.5 to 99.7 per cent.) should be used for formaldehyde vessels and thick material ($\frac{1}{4}$ in. to $\frac{5}{16}$ in.) has a life far longer in proportion than thin plate and is therefore ultimately much more economical. Aluminium, however, is not so good for pipe-lines or where erosion can accelerate the corrosion, and tinned copper pipes generally give most satisfactory service.

Storage Vessels

For storage vessels there is the choice of stainless steel, glass-lined steel, rubber-lined vessels, or tanks lined with enamels having a synthetic resin base. Wooden vats have been employed but, owing to the strong shrinking action of formaldehyde on the wood, leakages are a regular occurrence for months after installation and it is generally necessary to endure this for a year or so and then reconstruct the vessel after all shrinkage has taken place; it will then give good service. Probably the most satisfactory material for bulk storage vessels (to hold 50 tons or more) is reinforced concrete. The tank is fabricated in the same manner as those for water storage and afterwards lined with asphalt and acid-resisting bricks to protect the cement from attack by the formaldehyde or formic acid. A cheaper but less satisfactory lining is produced by treating the concrete, after thoroughly drying out, with hot paraffin wax, which is afterwards melted into the surface by the careful application of a blow lamp.

For centrifugal pumps stainless steel or acid-resisting bronze may be used, the latter material withstanding the action of formaldehyde very well indeed, while the most satisfactory valves appear to be those with flexible diaphragms. Ordinary gland and plug cocks last but a short time unless they are of the lubricated type.

Electrical Distance Thermometers

Speed and Facility of Reading

AS recorded in our leading article this week, there are few plant accessories of more general application than those instruments which measure the temperature at various stages in a chemical process, and the consideration of the best thermometer to use for any given purpose is always a matter of first importance to the chemical manufacturer.

A system well worth special investigation is that of the

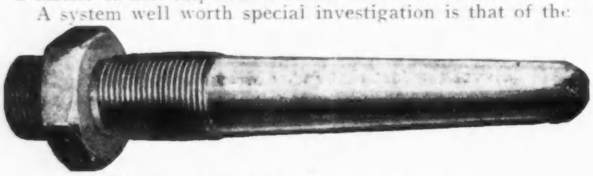


Fig. 1. Pocket for thermometer stem

distance thermometer, whereby the temperature recorded by a number of thermometers in widely separated positions may be read on one and the same indicator, placed at a convenient central location. Messrs. Elliott Brothers (London), Ltd., Century Works, Lewisham, S.E.13, have made a particular study of this system, and they have recently reprinted their catalogue (List 840) dealing with electrical distance thermometers. Space precludes more than a passing reference to the many types evolved, but the two illustrations herewith are typical of the methods of employing and reading the distance thermometers.

Fig. 1 shows a steel pocket for a thermometer stem. The use of this is necessary when thermometer stems are fixed into steam, water, or oil pipes, especially when the stem is subjected to considerable pressure. The pocket is screwed into the pipe, and the stem into the pocket. Thus the thermometer can be removed at any time from the pipe without the necessity of shutting down the plant where it is installed.

A typical multi-way selector switch and indicator com-

Fig. 2. Combined indicator and 10-way selector switch

bined in a metal weather-proof case for central reading is shown in Fig. 2. The selector switches are of the press-button type and are arranged in a circle. Any thermometer may be instantly connected to the indicator by pressing the corresponding button, and it will remain connected until a second button is depressed, when the first is automatically released. A central knob releases the last button depressed.

Electrochemical Analysis

New Gravimetric Apparatus

ANALYTICAL apparatus is an invaluable accessory to the industrial chemical plant and, especially in connection with metallurgical work, gravimetric electrochemical analyses provide the most rapid, accurate, clean and convenient methods available for determining the composition of many materials. The apparatus is basically simple. Inexperienced staff can rapidly be trained in its use—a factor of importance when labour is short. Accurate results are rapidly returned—some laboratories carry out upwards of 600 copper determinations daily, and there are now few routine estimations of metals in the commoner alloys that cannot be carried out more satisfactorily by electrochemical than by chemical means.

Messrs. Griffin and Tatlock, Kemble Street, London, W.C.2, have designed apparatus incorporating the features which, by experience in well-known laboratories, have

Single-unit electrochemical analysis apparatus, with automatic current controller

been found most advantageous for electrochemical work. Two types are available: a five-unit set for large scale use, and a single-unit set (illustrated herewith) for laboratories requiring a smaller output. Great care has been taken to produce apparatus modern from every point of view. Individual totally-enclosed ball-bearing motors are provided to each electrode pair. In the case of multiple units where "production analysis" is vital, continuity of use in the other units is thus assured should one motor break down. Systems in which a number of slave units are coupled to one motor do not give this assurance.

Each electrode pair in the rectifying system is electrically independent of the others, and is provided with its own rectifier, transformer and controlling equipment. An electrical breakdown does not therefore put the whole apparatus out of commission. The electrodes are available in two weights, approximately 40 gm. and 60 gm. per pair respectively. The heavier electrodes are recommended for routine use and are of a new robust type, the frames being stamped from sheet platinum. Welded joints, which in practice have proved to be a source of weakness, have thus been largely eliminated.

Corrosion resistance, the cause of many failures in earlier apparatus, has received great attention. Opal glass, vitreous enamel, ebonite, stainless steel and rhodium plating are used on those parts which cannot be located in positions remote from the beaker where acid spray is liberated. Armourplate glass is used for the working shelf.

Some Notes on Dryers

Recent Designs for the Process Industries

MANY materials, particularly those of a fairly free-flowing nature which have to be submitted to a drying or heating treatment in their production, are most conveniently and economically handled in bulk. Their commercial value or quantity, however, may not justify the expense of a continuously operated plant; while the filling and handling of the material on trays may not be desirable, owing to labour difficulties or costs.

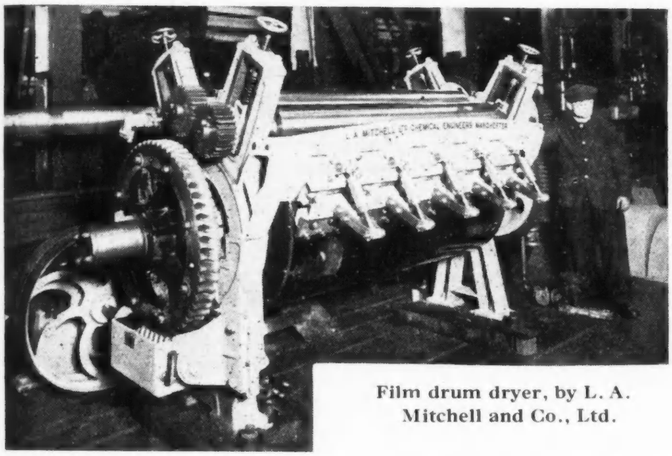
Mechanical Hot-Plate Roasters

For such cases a type of equipment is available which provides a convenient compromise in that relatively large quantities can be charged at a time while eliminating costly handling and high capital costs. The equipment usually takes the form of a squat heated cylinder having a flat base over which the charge is constantly agitated and moved. The cylindrical vessel may have both its base plate and its sides heated, depending upon the amount of moisture to be removed or the rapidity with which heating is to take place. Where underneath heat alone is applied by means of gas heating, the thickness of plate used must be adequate to ensure even distribution of heat. This form of heat can also be applied, where high temperatures are not essential by being steam-jacketed; similarly when the duty is fairly high the sides may be steam-jacketed to increase the heating surface. When uniform heating at fairly high temperature is necessary, and the use of naked flames is undesirable, high pressure steam or hot water coils are cast in both the bottom plate and the sides of the pan.

A variety of designs of agitating gear is available to suit different consistencies or types of charged material. Thus, inclined adjustable metal plates would be used for relatively light materials, while special forms of drag scraper arms of robust construction, staggered in their bearing action on the bottom plate, would be used for heavy, dense, materials. The effect of erosion or abrasion has to be considered in arriving at a suitable construction, and the adjustment of the angle of inclination or clearance must be decided upon. In special cases it is desirable to arrange for the raising and lowering of scraper arms.

Charging of the plant is generally carried out from a hopper, placed above, through an easily opened and sealed charging door on top of the pan. One charge is introduced at a time and its treatment completed before discharging and recharging. Discharging is automatically completed by the action of the scraper arms when the discharging door is opened. The latter may be either in the side or bottom of the pan; the design employed being most suited to operating conditions. A suitable arrangement of gearing and drive is provided for rotating the scraper arms. This may be fitted as an over-drive or under-drive, depending upon circumstances. Thus with a material which is likely to lead to abrasion troubles, the arms would be driven from above so as to avoid material entering shaft bearings and stuffing boxes. When vapours are evolved during treatment, as in drying, they can escape by an outlet in the pan cover. In some cases these vapours are led to a condenser for solvent recovery, and always in the special case where treatment has to be carried out under a vacuum. Vacuum conditions are employed as a rule only when rapid drying has to be carried out at relatively low temperatures, owing to the instability or sensitivity of the material.

Agitated hot-plate equipment of this type can be fabricated in different metals to withstand corrosion or iron contamination of the product. Thus stainless steel, mond metal, nickel-clad steel are used, or a special inactive or resistant coating of enamel or synthetic resin may be applied. The capital outlay attached to such plant is slight, and operating costs are economical. Power consumption is low and thermal efficiency is high considering the nature of heat transfer employed. Strong build and sound design are, however, essential to ensure low maintenance costs.



Film drum dryer, by L. A. Mitchell and Co., Ltd.

Film Drum Dryer

The Mitchell single-drum film dryer arranged with top roller feed, of type recently manufactured for export to Australia, as illustrated herewith, is especially suitable for the production of soluble cold-water starch pastes. It was originally developed on the Continent, although the design and construction has been considerably improved upon. With this machine the dried product is produced in the form of a flake or powder direct without handling in any way. The dryer is arranged with top feeding and spreading rollers for controlling the thickness of film on the cylinder; the dried material is cut off by means of doctor knives which are adjustable. The twin or double-drum film dryer which has proved so successful for drying milk and similar materials, has been applied to the drying of a number of other commercial products. But for a variety of reasons serious shortcomings and difficulties have presented themselves in practice. These have led to a search for a different design of film drum dryer which does not suffer from some of the inherent complications in the operation of double-drum machines.

Many materials, when fed between the two drums, undergo undesirable modification or decomposition, due to prolonged heating in the trough formed by the drum faces. Further, the very fact that the two drying drums form the seal at the base of this trough limits the clearance which can be set, particularly with thin solutions. Any tendency for dried material to build up on the drum surfaces results in undue strains being set up in the machine, with consequent fracture and excessive loading on the driving gear. In the Mitchell single-drum film dryer, these disadvantages are completely overcome. Undried material or solution is fed into the trough formed by two auxiliary small rolls, one of which is adjustable as to sealing position. Material delivered by these rolls on to the main drying drum passes as a fairly thick film on the surface of the latter and is doctored or spread out by a third independent and adjustable roller. The latter is capable of being either steam-heated or water-cooled to suit the nature of the raw feed. Film thickness is therefore independent of any sealing device. In addition no large quantity of raw material is at any time maintained in contact with heated surfaces for any unnecessary periods.

Climax Type C.30 electrically driven, two-stage, air-cooled, stationary compressor. Output, 115 cu. ft. free air per minute at 100 lb./sq. in. pressure.

Compressed Air Plant

Improved Design of New Compressors

THE convenience of compressed air, particularly as applied to the moving and agitation of liquids, has led to the extensive installation of compressors and air lines in chemical works. With the growing efficiency of compressors and the introduction also of numerous convenient and very economical tools and appliances driven by compressed air, such installations are rapidly growing in number and usefulness.

The form of compressor increasingly applied is well typified in the new Climax two-stage air-cooled compressor, in which the makers secure important economies based on research in compressed air engineering. In particular, high speeds, giving greater efficiency, have been made possible by a patented valve design which keeps air velocity low and prevents the falling off in volumetric efficiency hitherto experienced with sets running at over 1000 r.p.m. In fact, tests on this compressor give a curve showing an increase in efficiency at 1350 r.p.m. Air delivery temperature is reduced by the provision of air cooling for the valve guards and seats together with efficient intercoolers between the two stages of compression.

In designing the cylinder heads, advantage has been taken of recent research to apply the principle of streamlining, and an entirely new type of cylinder-head construction has developed. Results obtained have amply justified the contention that the old methods of using cylinder heads full of bosses and excrescences with no planned method of air flow meant loss of output.

Climax two-stage air compressors are available both as fixed units with direct drive by electric motor running at 1500 r.p.m. (or available synchronous speeds) and also as portable units with direct drive by diesel or petrol engine, or by electric motor. The portable units can be fitted with either pneumatic tyres and springs, solid types, or flanged steel wheels to run on rails. These compressors are normally available in sizes from 45 to 325 cu. ft. per minute F.A.D. at 100 lb./sq. in. pressure, and details, together with particulars of a complete range of up-to-date, high-efficiency, pneumatic tools, blowers, sump-pumps, etc., can be obtained from Climax Rock Drill and Engineering Works, Ltd., 4 Broad Street Place, London, E.C.2.

Tank Gauges

Accurate Measurement Assured

WHEN Messrs. Kelvin, Bottomley & Baird, Ltd., first produced the now well-known "Pneumercator" remote indicating tank gauges, the engineering world was quick to appreciate the simplicity, reliability and accuracy with which the contents of any tank could be measured by means of these gauges. Over 2500 ships and many thousands of tanks have been fitted with Pneumercator tank gauges.

Acids, ammoniacal liquors, edible liquids, fuel oils, fruit juices, coffee essence, petrol, printers' ink, wines, oils, molasses, etc., are only a few of the liquids which these tank gauges have been used to measure. In addition, tanks or vessels under pressure or vacuum are also measured. A high-precision model gauge enables readings to be taken to 1 mm. of liquid depth or the corresponding weight. For tanks of every shape or size, there is available a model of the Pneumercator rank gauge which will measure the contents in weight, depth or volume.

Many tanks, especially those containing inflammable, expensive or essential liquids, have had to be protected against enemy action. The old-fashioned and inaccurate measurement of tanks by dipping or sounding has become impossible because of the protective measures. The Pneumercator tank gauge occupies very little space and can be located at any distance from and at any point above or below the level of the tank. Pneumercator remote indicating tank gauges are available for every tank or vessel and are backed by over 20 years' experience of tank measurement by Messrs. Kelvin, Bottomley & Baird, Ltd.

A modern research laboratory is being built by the Metal and Thermit Corporation at Woodbridge, New Jersey. Completion is due on November 15. Special departments will be devoted to ceramics research, and research on arc-welding electrodes, and thermit metals and alloys.

Oil from Shale

New Catalytic Process from Australia

DEVELOPMENT of a new method of extracting fuel oil from shale is claimed by Clifford Hamey, an Australian inventor, after many years of research. Using a little-known catalytic action, with 4 lb. of torbanite, he produced a high-octane spirit at the rate of 196 gallons to a ton. He further claims that, using cannel coal, from which a private experimenter had recovered 96 gallons a ton, he has extracted 200 gallons of fuel oil per ton.

Provided essential materials can be obtained, plant of new type could be erected for £35,000 to operate in three months, with a yield from average shale of 60,000 gallons a week. It might, however, require 12 months or more to reach full scale production.

Mr. Hamey states that the cost of the new fuel to the consumer would be no more than the ruling price of motor spirit. Kerosenes and other oils could also be produced, and valuable by-products recovered, among which are acetone and ammonium sulphate. One Queensland shale field alone would yield under the new process, says the inventor, about 755 million gallons of petrol a square mile, at 150 gallons a ton, provided that the survey information is accurate.

THE ETHICS OF CHEMICAL ENGINEERING

The Proper Use of Special Knowledge

By "WORKS CHEMIST"

CHEMICAL engineering, like all subjects of importance, is controversial. The controversy may well start with the title, for *chemical* engineering is rarely concerned with chemistry. It might be defined as the art of designing or constructing vessels in which chemical reactions take place. That definition might be too narrow because those who operate processes and thereby control chemical engineering plant will often describe themselves as "chemical engineers" even though others may describe them as "process chemists" or "works managers." Much depends upon the nature of the process. If the process consists of nothing more than carrying out a reaction in a closed vessel and then separating the products it is perhaps difficult to substantiate a claim for the control of the process to be termed "chemical engineering." It often happens, however, that a works may carry out a chemical process which involves handling considerable quantities of material—solid, liquid, and gaseous—by engineering plant of considerable complexity. Although the chemistry side of such a works may be comparatively simple, the engineering is complicated. Under these circumstances the term "chemical engineering" is applicable. As the engineering side becomes more in evidence than the chemical control, it is found that the works may be put under the direction of an engineer rather than a chemist or a "chemical engineer." It is fairly evident that for the control of these works the term "chemical engineer" is a misnomer; the chemistry of the process is taken care of by the chemist, the engineering by mechanical or electrical engineers. The chemical engineer has to provide for the physical accompaniments of the chemical reaction. He has to apply or abstract heat; he has to design and construct plant to stand pressure or to operate under a vacuum; there may be electrical effects which have to be taken into account; and so forth. There seems, therefore, to be some justification for calling the chemical engineer a "physical engineer" or an "applied physico-chemist." As engineering is substantially applied physics so chemical engineering is the application of physics to chemical processes.

Working in Figures

This insistence on applied physics brings to mind the fundamental distinction existing between the pure physicist and the applied physicist. The pure physicist or physical chemist works in symbols. He is content if, on starting with certain assumptions, he can grind them through the mathematical mill and end with an expression comprising many Greek and Roman letters, spiced by the mathematical signs of differentiation and integration. When he reaches this stage he announces proudly the discovery of the laws from which physical or physico-chemical processes follow. There he stops. It seldom occurs to him to translate his "formulæ" into figures. Thereby, he misses a good deal which the practical physico-chemist must discover. From the nature of his work, the practical man must work in figures; it is only when numerical examples are worked out that the implications of abstract reasoning are revealed. Sometimes they may be revealed as striking truths, shedding a flood of light on natural phenomena. Sometimes they are revealed as foolish improbabilities. All theoretical scientists should translate their labours into the realms of reality—but they don't, and thereby they miss much.

The essential fact that emerges from all this is that the practical physical chemist, or the chemical engineer as we will once again style him, is pre-eminently a practical man dealing with practical problems. Because he is a practical man he will find it advantageous to understand the theoretical conceptions of his more academic friends and to think things out for himself by translating them into practical units. Quite often through the medium of abstract mathematical inquiry, which has previously been made by others, he can deduce improvements in the processes that would not be obvious to the academic mind, because it lacks the incentive to translate the mental concepts of the mathematician and the physicist into practical terms of metals, ceramics, chemical products, and so forth. Moreover, because the chemical engineer is engaged in translating scientific knowledge into practice, he must come into wider contact with the economic realities of business than most other people, even those on the technical side of the industry. The chemical engineer is thus in more senses than one, the link between theoretical science and industrial technology.

The Provision of New Plant

One of the tasks which confronts the chemical engineer is the provision of new chemical plant. Being practical men accustomed to translate theoretical concepts into practice, chemical engineers will naturally approach their task realistically. What then should be the reaction of the chemical engineer to a demand from his directors that he should proceed to manufacture a finished product, which he has never made before? It may be, for example, that in the course of many years of operation there has been produced a by-product "A" for which no use has been found. It may be known, however, that this by-product can be converted by suitable treatment into products "B" and "C" which have a commercial value. How should the works chemical engineer proceed to translate this order into practice if the process required is not one of which he has intimate knowledge? The first course open to him is to seek for chemical engineering contracting firms that have had experience of this class of work. There are in the chemical industry a number of processes which are sufficiently well known and standardised for there to be firms that have erected one or more plants in which these processes are conducted. These firms will have no difficulty in designing the necessary plant and in guaranteeing the result. They will be prepared to make or purchase the component apparatus, to erect it as a finished unit and to operate it until its guarantee is fulfilled so that it is turning out a satisfactory product. The manufacture of sulphuric acid or soda ash would come under this category. There may be more than one firm that can undertake the work on this basis. What should then be the method to be used in selecting the design? The commonest method is to send an inquiry to all the firms known to specialise in this class of work, to invite them all to quote, and to accept the lowest price. Not infrequently this method is varied by the less scrupulous, who discover from the several proposals a number of useful suggestions, and then unblushingly steal them, collecting them together in a comprehensive scheme. The chemical engineer in question may then himself purchase the several items of plant required direct from the manufacturers; or he may select one of the specialist firms to carry out the work. This method may no doubt be considered as "good business" for the chemical engineer's own firm, but it is not on a high ethical plane. It is, in short, a method to be deprecated.

The proper method to adopt where specialist firms exist will no doubt depend upon the process. It may be that it is an established process in which there is comparatively little variation. In these circumstances the best principle is to select one firm to carry out the work. The method of selection may be by the relative merits of the proposals, by reputation, or by price. If proposals are of equal merit, it is often better to select by reputation. A well-established firm of high integrity will do all in its power to maintain its reputation—and reputations are all

too easily lost. A particular firm, the quality of whose work is already well known, is then entrusted with the task of carrying out the work on an agreed price basis without reference to the estimates or proposals of rival constructors.

There are comparatively few purchasers who are prepared to trust the constructional firm in this way; it is more usual to call in at least two, and often more, concerns which make rival proposals. That firm is then selected to carry out the work whose proposals appear to be the most satisfactory. The satisfactoriness of the proposals may depend (a) upon the price and (b) upon how the proposals themselves stand the analysis which the expert chemical engineer will give them. There is a certain amount of expense, often considerable expense, involved in making quotations. But constructional firms would rather stand the expense and take their chance of getting the work than be left out in the cold. It is, however, wrong policy to ask firms to quote with whom it is not intended in any circumstances to place the work.

In chemical engineering plant, and indeed in most process plant, minor differences in price matter little; but it is of the greatest importance that the plant shall be good. Where an expensive plant is required for making a comparatively cheap product, it may be that the interest and depreciation on this plant represents a considerable fraction of the cost price. When this happens, price assumes much greater importance than under circumstances in which the value of the product is very much greater than the interest and depreciation of the plant. Probably, this should be the deciding factor between giving the work to a firm on reputation and giving the work to a firm on price. Nevertheless it must never be forgotten that long life reduces the cost per unit of product made, so long as the design of plant does not in the meantime become obsolete. Quality of plant counts for a great deal.

The Cost of Estimating

It frequently happens, however, that the process to be used is not a standard one, but one in which the plant has to be built up, as it were, from first principles. There are three possible methods which can be used. One of these is to submit the whole proposals to chemical engineering constructional firms of the type just mentioned, and ask them to work out a scheme. This is a method which may entail considerable expense on the part of the firm or firms asked to quote. These firms maintain laboratories in which problems of this nature can be worked out. It will be necessary for them to analyse the raw materials and to determine what method or methods should be used. When they have developed these on theoretical grounds they will then have to carry out the complete process sometimes on a small scale, then on a larger scale, until they are satisfied that sufficient information has been obtained for the initial purposes of the design department. The design department must then make drawings of the complete process and design mains, pipes, vessels, pumps, and so forth, sufficiently accurately for a price to be built up. The estimating department must then get to work and in the end a finished scheme is evolved which perhaps only occupies some 2 or 3 pages of type. The work may have cost much money, but that is not evident in the tender as it is received.

All too often the same inquiry is put to three or four firms, only one of which can obtain the work. It is not surprising that when work of this kind is required many firms demand payment for the work done, irrespective of whether an order is placed or not. It would be all to the good if this principle were to be generally adopted throughout the whole of the chemical industry. Failure to adopt it means that the price of plant generally must be advanced to maintain the necessary laboratories, which would work free of charge for chemical manufacturers generally; that, in the writer's submission, is not desirable. If a firm desires to manufacture a new product it should not expect chemical plant constructors to sell them a ready-made business for the price of the plant. That, in a nutshell, is what the practice amounts to. A firm of any standing will develop its own processes, if there is anything novel about them, and will not expect constructional firms to do development work for it, unless proper arrangements for payment are made.

Co-operation or Consultation

The most satisfactory way of undertaking this particular class of work is to approach all the firms likely to have had experience of processes of the same nature as the one to be undertaken, and to put the facts before them fully. Each of these firms will then be asked: "Under what terms will you co-operate with us to develop a process and erect a plant." On the basis of the answers received from this questionnaire one firm would be selected, and would be regarded as the consultants for the job. When the process has been worked out this firm will also be entrusted with the supply and erection of the necessary apparatus.

The second method is the employment of the consultant. It is frequently possible to find a consulting chemical engineer of wide experience and with sufficient knowledge to design a plant that will have a good chance of operating satisfactorily. When these designs have been thoroughly discussed and in their final form adopted, the consultant should then be in constant touch with the buying, erection, and operation of the plant, until it finally functions properly. The fees for this work may be large but they should be no greater and possibly less than the cost of giving the work to a chemical engineering and constructional firm to undertake.

The third method, which is generally only open to the bigger chemical manufacturers, is to develop the process entirely by their own staff and in their own laboratories and drawing offices. This involves a good deal of experimental work, expert knowledge in plant design, and so on, after which the individual parts of the plant can be bought from plant manufacturers. Probably this is the method which will be most generally adopted in the future. Industry in general tends to be concentrated in larger units and these larger units contain the necessary laboratory facilities, chemists, drawing-office staffs, chemical engineers, and designers, who between them can work out any possible new process which may be required.

It is likely, therefore, that consultants and specialist firms of plant designers will be of decreasing importance as the years advance. That is a point upon which there are many differing opinions, but the general tendency of industry is in that direction. The consultant will be more likely to disappear than the plant designer and builder, because plant construction will always be necessary and the firm that acts as the link between the plant constructor and the chemical manufacturer is performing a valuable duty and is relieving the chemical manufacturer of a great deal of work.

The Function of Specialist Firms

In certain well-established industries in which the construction of the plant is fairly well standardised there still exist specialist firms who are entrusted with the design and construction of new plant throughout the whole industry; these firms have the advantage in that by being continually engaged in the design, erection, and starting up of these installations, they amass a volume of experience never approached by the individual manufacturing firm or by any individuals in its employ. In certain industries, therefore, the constructional specialist firm will continue to exist and to fulfil a very useful function. This function will be principally in connection with industries where there are many installations similar, but not identical in character. In those sections of the chemical industry where there are few plants to be erected it is more likely that chemical manufacturers in the future will rely upon their own staff supplemented by specialist chemical manufacturers who make plant for unit processes.

This brings up the difficult question of the manufacture of plant for unit processes. It is quite evident that if we consider, for example, distillation, there may be many different ways of arranging a plant for the distillation of any particular product. The science of distillation is complex and it is well that there should be specialist firms, which engage in research work, develop new processes,

and can design and manufacture plant. The same is true for all other unit processes. The chemical plant manufacturer of the future will therefore be a manufacturer of plant for one or more unit processes, and into that plant he will put new ideas as they occur to his staff and embody ing the results of experience built up over many years. It will happen from time to time that individuals or new companies will desire to take part in the manufacture of these plants. How can that be done? Quite frequently the proposed chemical plant manufacturer is in an engineering works. They have learned, let us say, that autoclaves are required for the chemical industry, and they have been accustomed to making pressure vessels of a simple design. How are these firms to begin to manufacture autoclaves for particular chemical processes? Being engineering firms, the only method which suggests itself to them is that they shall quote prices whenever they can get inquiries until they ultimately get a certain number of orders and begin to get experience. Their fundamental difficulty, however, is that they lack the expert knowledge of the chemical industry which enables them to design the apparatus. They therefore cast about to discover someone with the necessary knowledge who will design the plant for them. Unfortunately they cannot afford to pay a consultant's fees for designing plant for tendering purposes only. Some have thus hit upon the device of offering the consultant a percentage of the selling price if an order is obtained. This method of doing business is used in some instances, but is condemned by many consultants. It is obviously an unsatisfactory method for a busy consultant because about nine-tenths of his work will be done without payment. It is a method which depends for its value upon straight dealing between firm and consultant.

The Dangers of "Commission" Work

The consultant who has not a large practice may find this a very suitable method of getting a start because very often his time would not be otherwise occupied. He thus acts in effect as an indispensable member of the estimating department working on commission only. This "semi-paid consultant" class of work is of no use to anyone unless he has an agreement lasting over a long period of years *and* the firm conscientiously keeps to the letter and spirit of the agreement, so that all plant of a particular type manufactured by them, whether specifically designed by the consultant or not, shall be treated as ranking for commission. The constructional firm for its part must be chary of encroaching upon their consultant's time. He should not be asked for designs unless there is a very real chance of obtaining the work. Under these conditions of mutual straight-dealing and understanding the method may be one of considerable utility to both sides. It is to be noted that precautions must be taken against the danger of a perfectly honest firm being misled because of changes in its own staff. It may be that the arrangement here visualised may have been in satisfactory operation for some years and then through a change in staff it is forgotten and a new draughtsman may utilise existing drawings without reference to the consultant. Orders may be obtained and carried through without the knowledge of the office staff who calculate the commission. It seems evident, therefore, that the ideal arrangement is for the plant constructional firm to engage the consultant as a *bona-fide* consultant, and to pay him an annual (possibly modest) retaining fee, plus a commission on all work of the types in regard to which he advises and which may be constructed in their works.

Whilst on this subject some consideration may be given to the difficult question of the outright sale of expert knowledge. The circumstances previously given do not relate to an "outright" sale of knowledge, for the consultant supplies designs for each case as it is put before him. There are circumstances, however, under which when once given, the information passes to the recipient and can never be withdrawn. It may be, for example, that a firm specialises in pumps and it may also be that an individual has in his possession specialist knowledge of the design of a pump hitherto manufactured abroad that is not patentable in this country. Once the essentials of the appliance are disclosed, the individual is of no further value to the constructional firm. Or again, a chemical process for manufacturing a particular material may be involved. Once the secret is disclosed, the cat is right out of the bag. The individual may have all the expert knowledge upon which the design and operation of the new plant can be based. The constructional firm may have the plant to manufacture the apparatus and the organisation to obtain orders. On what basis can these two come together? This is not an academic problem. There must be many individuals with special knowledge of German processes How can that knowledge be made available to British firms? The problem is difficult. Too many firms obtain the required information and then take the first opportunity of refusing to pay further fees to the man from whom they have originally obtained the information, upon which the new business can be built up. It is impossible to propose a solution on a basis of mutual trust if only because of the difficulties which may be involved by a later change of staff or directorate.

A War-Time Problem

The individual happens to have special knowledge and experience which are of no value to him unless he can use them. By parting with them he may cut himself off from Continental associations that may be of value after the war. The firm that obtains the information is given the opportunity of improving its products or of starting on new and probably lucrative lines, without any effort other than organisation of sales and manufacture. The firm, however, takes a financial risk. Not infrequently firms are asked by Government departments to disclose private information to their competitors under the excuse that to do so will assist the war effort. What should be their policy? The answer to these conundrums must depend on circumstances. If an individual possesses certain knowledge which will benefit the country, that knowledge should be at the country's disposal. But the country cannot expect to receive it free of charge, nor does it if we are to judge from the awards paid to inventors of weapons of war after the termination of hostilities. If the knowledge is not being commercialised and cannot easily be commercialised by the possessor, the reward would be that paid to a consultant plus a small percentage on returns if it were commercialised by industrial undertakings. If the individual happened to have based a business upon that knowledge, a business that was perhaps being conducted in collaboration with those who are now the country's enemies, a business, moreover, that would not be revived after the war if the knowledge was imparted to competitors here, the reward proper would appear to be an annual sum equal to the profits derived before the war from that business as accruing to the individual.

That, however, brings up again a question of ethics, whether in fact in any circumstances it is right for the individual British citizen to disclose in this way information, derived from acting as the agent to an enemy firm. If the disclosure of the information would conduce to his country's safety, there can be but one answer; but if it is only to be used for gaining a trade advantage over those who are now our enemies and who must inevitably one day cease to be enemies, what then? If science is international and overleaps the boundaries of countries, does that alter the ethics of the right way for a chemical engineer, in many respects a highly scientific man, to answer this conundrum? It is not everyone in business who possess that "honour that knows the path, and will not swerve." The reply might have been given by a modern business man: "Oh, a mighty large bed; bigger by half than the great bed at Ware—ten thousand people may lie in it together and never feel one another."

Re-exports of tungsten ore (65 per cent. WO_3) from Hong Kong to the United States amounted to 147 long tons in the second quarter of 1941, compared with 39 tons in the first three months of the year. Shipments to the Soviet Union are estimated at about 100 tons a month; exports to other countries, including Great Britain, are negligible.

The Training of a Chemist

The Virtues of Practical Work

PRACTICAL and constructive criticism of the present-day training of young chemists was enunciated by Mr. Thomas McLachlan, A.C.G.F.C., F.I.C., at a recent Saturday afternoon meeting of the British Association of Chemists. Mr. McLachlan is widely known as a consulting and analytical chemist of long experience and many young chemists have passed through his hands; in other words, he is fully qualified to speak on the subject. The speaker's training was begun under H. E. Armstrong at the old Finsbury College, and continued under Meldola and Streatfeild, and, as he pointed out, there was something present in the Finsbury training that is missing in modern university practice. Comparison of the present-day student with his counterpart of those days led to the conclusion that there were two main differences in the training. Teachers such as Armstrong and Meldola exhibited an extraordinary catholicity of interest. Armstrong "would write to *The Times* or *Nature* on almost any subject"; Meldola would have made a front-rank entomologist; Streatfeild had taken to chemistry because he could not afford to complete a medical course, and so on. The second great distinction is that the modern student does not have "to roll up his sleeves and dip his hands in the muck." Mr. McLachlan confessed that it was only because he had yielded to *force majeure* that he introduced washers-up into his own laboratory.

The modern student, he declared, "comes into one's laboratory with a complete knowledge of theory and knows exactly where to turn up a point in his text-book. He can write down the formulæ of alkaloids and dyestuffs, discourse at length on parachors and heavy hydrogen . . . but he is usually unable to hold a test-tube properly, and the reading of a hydrometer is something beneath his dignity." Another fundamental weakness of the chemical profession was that the chemist lacked the *savoir faire* of the physician or the engineer. The chemist should have windows at the side of his laboratory from which to survey the world, and his laboratory should, in truth, be the whole factory. Mr. McLachlan suggested, as remedial measures, that chemical students, selected because of their keenness for the subject, should enter the university at an earlier stage; they should study a wider range of subjects and obtain a more practical knowledge of those studied; and, most important of all, there should be far greater contact between the training in the university and the life to be led in industry. This last would include a more generous exchange between professorial and industrial appointments. Professors should act as consultants for industrial concerns, and firms should finance the seconding of members of their staffs to research institutions. Finally, room should always be found for the exceptional chemist, who is a chemist by nature and possibly without what may be considered "adequate training."

Mr. McLachlan's paper was greatly appreciated by a representative audience, and was followed by an animated discussion, in which Dr. Himus and Professor Donnan took part; also Mr. Peck, who presided, Dr. Dunstan, Mr. Sweeten, Mr. Cook, Mr. Pinder, and Dr. Sutherland.

A CHEMIST'S BOOKSHELF

THE APPLICATIONS OF CHEMICAL ENGINEERING. Ed. by H. McCormack. London: Chapman and Hall. 431 pp. 21s.

The title of this book is misleading; it is not concerned with the applications of chemical engineering to industrial processes as might be imagined, but is in effect an advanced text book on laboratory procedure for undergraduate students of chemical engineering. Like most text books on chemical engineering it emanates from the U.S.A. and owes its origin to the need for a practical laboratory manual in chemical engineering, a matter which was first discussed at the American Institute of Chemical Engineers' Conference on Chemical Engineering Education in Philadelphia in 1929, and at a succeeding conference in 1935. Professor McCormack was appointed Chairman of a Committee of Chemical Engineering Laboratory Instructors, the members of which have themselves and with outside assistance written this volume, in which they have collected and unified the best available material. The basis for the evaluation of the material included in the book has been threefold; satisfactory use in a private laboratory over a period of time; suitability for use with simple equipment that is readily available or that may be constructed without undue difficulty; and, finally, the definite relation of each experiment to the theoretical presentation of chemical engineering and its possibility of accomplishment in a single four-hour laboratory period.

The general scheme of the book is to divide chemical engineering into eleven sections dealing respectively with the measurement of temperature, the flow of heat, evaporation, distillation, the drying of solids, humidification and dehumidification, gas absorption, filtration, classification and concentration of solids, and size reduction. Each chapter comprises first a brief, but generally satisfactory, statement of the general principles of the subject with a good bibliography, and second a number of experiments upon the subject. In some of the sections useful sample data and detailed calculations are also given.

The book presupposes that apparatus, generally simple in character, but of a size and complexity which can only be found in a well-equipped chemical engineering laboratory, will be available. Although this is the immediate intention of the book, we feel that it will have a wider application because many of the determinations and exercises here given are met with in practice. The hints and instructions here given will be of considerable value, especially when dealing with unfamiliar determinations. How many chemists or chemical engineers, for example, who were not intimately concerned with distillation would know how to proceed if they were baldly asked to determine the performance characteristics of a batch column still, to determine the plate efficiency of a still under actual operating conditions, and to determine the reflux ratio required to produce a given rectification in a column still by comparison with the calculated minimum reflux ratio? This is an unusual book and one which we consider will be of great general value to the chemical engineering profession.

There are a few changes that will, no doubt, be made in a future edition, particularly the omission of letters from certain diagrams where they are referred to in the text, but these are only minor blemishes in an otherwise excellent book.

Formation of Nitrous Oxides

Electric Discharge for Nitric Acid Production

A NEW type of electric discharge has been applied to the oxidation of nitrogen and, ultimately, to the production of nitric acid, by P. A. Serebriakov (*J. Phys. Chem. Russ.*, 1940, *14*, 175). This "torch discharge" takes place in air under atmospheric pressure when a high-frequency (10,000 kc. per sec.) alternating current is supplied to a needle electrode. The discharge is started by switching on 1000-1500 volts; after it has started the voltage can be reduced to 600-800 volts. The volume of the "torch" is proportional to the number of watts supplied.

When the "torch" burns in an air stream the outgoing gas contains NO. The percentage of NO increases with the volume of the "torch" and with the time taken by a given volume of air to pass through the discharge vessel. Thus when this time increased (*i.e.*, the rate of flow is lowered) the percentage rises to about 3 per cent. whatever the number of watts supplied. If the number of watts is referred to the volume of air flowing per second (*i.e.*, if it is divided by the rate of flow) it is seen that the percentage of NO is independent of the total watt number at all rates of flow, and only depends on its ratio to the rate of flow. The yield of NO per watt-sec. has a maximum at some medium rate of flow, *e.g.*, at 25 litres per hour for 140 watt. The highest yield observed corresponds to 63 g. HNO_3 per kWh.

Fire Prevention Scheme

Terms of the New Order Discussed

COMPLEXITIES of the new Fire Prevention (Business Premises) (No. 2) Order, 1941, were discussed with THE CHEMICAL AGE by officials at the Home Office on Monday. This Order, now and in the future, will bear heavily on most business houses, and it is necessarily complicated, especially since the Government has decided that the Exchequer shall reimburse employers for amounts expended as their fire guards' subsistence allowances.

The new Order establishes subsistence allowances (the cost of which will be defrayed by the Exchequer) on a fixed scale as follows:—

	s.	d.
For a continuous period of fire prevention duty, outside working hours, not exceeding 12 hours	3	0
For a continuous period exceeding 12 but not exceeding 18 hours	4	6
For a continuous period exceeding 18 but not exceeding 24 hours	6	0

The Government is most anxious that the change of system regarding subsistence allowances shall not be taken as an occasion for departing from arrangements which may have been made between occupiers and employees which provide for the payment of allowances at higher rates. Out-of-pocket expenses for travelling reasonably incurred by fire guards are to be refunded by occupiers. Fire prevention arrangements which were approved under the previous Business Premises Order will not in general need to be renotified under the new Order.

All these points and many others arising out of the new Order are dealt with in a memorandum prepared by the Ministry of Home Security and the Scottish Home Department in consultation with representatives of employers' organisations and the T.U.C. Principals of firms concerned will shortly be able to obtain copies free of charge.

Joint Schemes

As regards the reimbursement of expenditure on subsistence allowances, while the Government hopes that those firms paying more than the official scale allowances will not reduce them, recovery is for the amount of the scale, not the amount paid above it. Two forms, "A" and "B," applying respectively to premises where more than 30 people and fewer than 30 people work, can be obtained in quantities from the appropriate authority, and are to be made up each seven days and lodged with the authority every four weeks. Firms participating in joint schemes may agree to appoint one of their number to act as joint paymaster, providing that the agreement of the others is sent in writing to the authority, and that they agree also to abide by the receipt which the "paymaster" will give to the authority for monies due. On the other hand, each occupier in a joint scheme may claim separately, but the claim forms must go in centrally from an occupier to whom his fellow occupiers agree to assign this duty.

These arrangements, be it noted, all take effect on and from Monday of this week (September 22). There is no option about payments—the allowances *are* to be paid. The words "appropriate authority" mean that local or national governmental authority to which the occupier is ordinarily responsible now, and the complete list will be found in the explanatory memorandum.

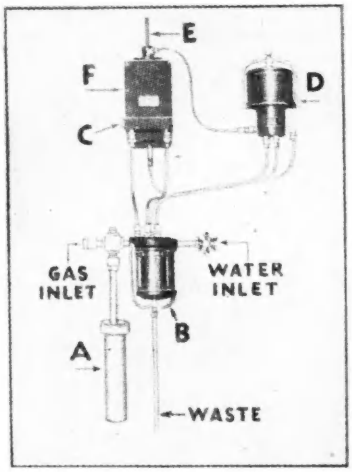
The following notes may be useful: (i) The sum of 3s. is the very minimum for any tour of duty, of whatever time, not exceeding 12 hours. (ii) The term "working hours" means all the hours worked by a man and therefore *includes* overtime. (iii) Voluntary schemes now in operation are covered in the same way as any compulsory scheme which may be adopted under the new Order. (iv) A whole-time fire watcher is *not* doing duty "outside working hours." His "working hours" are when he is fire watching, for which he is paid a wage. (v) Women fire guards may be included as volunteers. Aliens also may be included if (a) the premises are not of the class where their presence is prohibited, and (b) they obtain a certificate exempting them from curfew restrictions.

Oxygen Recorder

Operation of an American Instrument

INFORMATION comes from America regarding a completely automatic oxygen recorder. No chemicals are used with this instrument, which operates from the electric supply line and provides continuous indication and graphic record of the amount of oxygen in any gas. The operation of the instrument is simple. Gas is drawn into the analyser by a bubbler-aspirator B, the condensate falling into drip pot A. The aspirator maintains sufficient suction to draw a total quantity of approximately one litre of gas per minute through the inlet and, at the same time, the bubbling action serves to scrub the sample. The gas is thus scrubbed and measured by the aspirator. At the elbow the incoming gas divides into two streams, one of which flows directly to the aspirator; this is the larger stream and acts as a line purge. The remaining gas flows through a secondary filter and orifice C, and thence to an inner bubbling tube in the aspirator. The pressure drop across the orifice, as well as the flow through it, is constant. Within wide limits this flow is independent of both the total gas flow and of the restriction in the remainder of the apparatus.

The gas sample is collected by an inner bell in the



bubbler and from there it passes to one side of the analysing cell D, then flows through tube E in the furnace, back through the other side of the analysing cell and then to the bubbler-aspirator where it goes to waste along with the main gas stream. The centre tube E of the furnace contains a carbon rod, heated so that any oxygen in the gas passing over it is converted to CO_2. The supply of carbon in the furnace is usually sufficient for more than a week's operation, depending, of course, upon the oxygen content of the gas being tested. The carbon is automatically fed into the furnace and the flow of gas controlled at a figure which, while conserving the carbon rod permits the rapid response of the apparatus. One side of the analysis cell D is exposed to the original gas containing oxygen, while the other side is exposed to the same gas, with the exception that the O_2 has been converted to CO_2. The meter unit is arranged to measure the difference in thermal conductivity between the gases on the two sides, which is obviously proportional to the oxygen concentration of the original gas. The result is not affected by any changes in the original CO_2 or N_2 concentration.

Methallyl methacrylate is produced, according to U.S.P. 2,250,520 (Celanese Corp. of America), by adding methacrolein to a suspension of aluminium alcoholate, in a carrying agent, then heating the mixture under reflux and finally separating the methallyl methacrylate formed from the reaction mixture. The methacrylate may be polymerised to form a resin and during the polymerisation may be shaped to any desired form.

Personal Notes

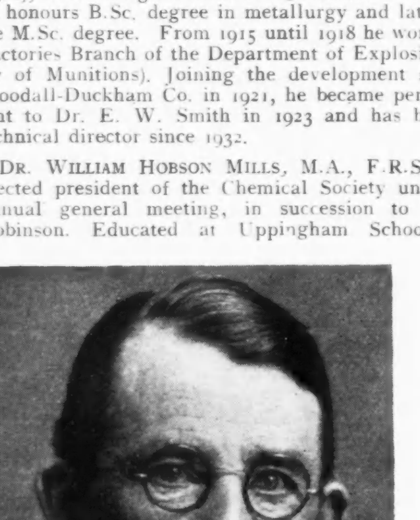
MR. PERCY H. RUSSELL, who is a representative of the Lawes Chemical Co., Ltd., in Essex, has been appointed Branch Secretary of the Executive Committee of the Chelmsford Branch of the Essex County Farmers' Union.

MR. T. C. A. MEYER has been elected President of the Chemical, Metallurgical and Mining Society of South Africa for the year 1941-42. The other officers are: Vice-presidents, MR. J. V. MULLER, PROFESSOR F. J. TROMP, PROFESSOR C. W. BICCARD JEPPE; hon. treasurer, DR. P. N. LATEGAN.

MR. GORDON ROBBINS, Deputy Chairman of Benn Brothers, Limited, the proprietors of THE CHEMICAL AGE, was last Saturday unanimously elected President of the Institute of Journalists for 1942. He is the third member of his family to be appointed to that position, as his father, Sir Alfred Robbins, was President in 1907-8, and his brother, Mr. Alan Pitt Robbins, News Editor of *The Times*, in 1935.

MR. T. C. FINLAYSON, M.Inst.Chem.E., M.Inst.Gas E., F.Inst.F., has been appointed a director of the Woodall-Duckham Vertical Retort and Oven Construction Co. (1920), Ltd. He graduated at Manchester University with an honours B.Sc. degree in metallurgy and later obtained the M.Sc. degree. From 1915 until 1918 he worked for the Factories Branch of the Department of Explosives (Ministry of Munitions). Joining the development staff of the Woodall-Duckham Co. in 1921, he became personal assistant to Dr. E. W. Smith in 1923 and has been deputy technical director since 1932.

DR. WILLIAM HOBSON MILLS, M.A., F.R.S., has been elected president of the Chemical Society until the next annual general meeting, in succession to Sir Robert Robinson. Educated at Uppingham School and the



Dr. W. H. Mills, President of the Chemical Society

[Elliott & Fry

Universities of Cambridge and Tubingen, he was elected a Fellow of the Chemical Society in February, 1898, and served on the Council for six years. He is a Longstaff Medallist of the Chemical Society, Davy Medallist of the Royal Society, and Fellow and Lecturer of Jesus College, Cambridge. In addition, he is chairman of the Chemistry Research Board, D.S.I.R., and was head of the Chemical Dept., Northern Polytechnic Institute in 1902-12. In 1937 he was Baker Lecturer at Cornell University, U.S.A.

Obituary

DR. WILLIAM REGINALD ORMANDY, D.Sc., F.C.S., F.I.C., M.Inst.Chem.E., the well-known chemical engineer, died at Moreton, Cheshire, on September 12, after many years of ill-health, aged 71. A native of Chorley, Lancs., he was educated at Wigan Grammar School and School of Mines, and at the Universities of Manchester and Tübingen. He had practised long and successfully as a consulting and research chemist and was particularly interested in physico-chemical problems relating to liquid fuels and the electro-osmotic treatment of refractories. In addition to the societies mentioned above, he was a member of the Institutes of Fuel, Petroleum, and Automobile Engineers (past president) and had served on the Empire Fuel Committee.

Heat of Formation of Oleums

New Set of Values Calculated

THE heats of formation and infinite dilution of oleums have been recalculated by C. V. Herrmann (*Ind. Eng. Chem.*, 1941, *33*, 898) from all available data, including those of Knitsch, Thomsen, Bichowsky and Rossini, and the Howard test. A new set of consistent values has thus been derived. The accompanying table shows the values of the heat of infinite dilution of oleums at 18° C., based on a mean curve which takes account of the relative accuracy of available data. For use in engineering calculations involving the thermochemical properties of oleum, a table in the original article gives values of the heat of formation from liquid water and either liquid or gaseous sulphur trioxide. Values for liquid water and liquid SO_3 were obtained by subtracting the heat of infinite dilution of the oleum from the heat of infinite dilution of SO_3; and values for liquid water and gaseous SO_3 were obtained by adding the heat of vaporisation of SO_3 (10,300 calories per gram mole of SO_3).

Per cent. SO_3 in oleum. Free	Total	Heat of infinite dilution, in kg.cal./gram mole of SO_3	Per cent. SO_3 in oleum. Free	Total	Heat of infinite dilution, in kg.cal./gram mole of SO_3
0	81.63	22.06	60	92.65	34.05
10	83.47	23.95	70	94.49	36.20
20	85.30	25.90	80	96.33	38.40
30	87.14	27.90	90	98.16	40.70
40	88.98	29.90	100	100.00	43.23
50	90.82	31.95			

British Chemical Prices

Market Reports

FAIRLY active trading conditions have been in evidence during the past week, the firmness of quotations being the chief feature of the market. At the consuming end delivery specifications cover good volumes, and the movement in this respect has been of substantial dimensions. Items such as caustic soda, bicarbonate of soda and hyposulphite of soda are receiving a good inquiry whilst limited offers of yellow prussiate of soda and chlorate of soda are finding a ready outlet. A good demand is maintained for bichromate of soda and also for bichromate of potash at the higher values now ruling. In the acid section there is a good call for boric and hydrochloric acid, while oxalic acid remains in short supply. In the market for coal tar products values show no sign of weakening, and most of the leading items are well forward on delivery. Pitch and pyridine remain the dull spots although a little more inquiry for the latter item is recorded.

MANCHESTER.—While a moderate volume of new business is reported in heavy chemicals on the Manchester market the call for supplies against existing contracts is on steady lines, with prices firm pretty well throughout the range. There is a good demand for rubber chemicals, with a fair trade going through in materials for the textile sections. In the tar products market higher prices are being indicated for cresylic acid and the crude descriptions of naphthalene, but with spot supplies very scarce values must be regarded as more or less nominal.

GLASGOW.—There is a slight improvement in the Scottish heavy chemical trade during the past week for home trade. The export business is still rather limited. Prices keep very firm.

Price Changes

Cresylic Acid.—Pale, 99/100%, 4s. 3d. per gal. MANCHESTER: Pale, 99/100%, 4s. 9d. per gal.

General News——From Week to Week

Large scale damage to crops by poison gas is improbable, but incidental contamination, especially near towns, may occur. "Growmore" leaflet No. 38 gives useful advice on the subject, and may be obtained free on application to the Ministry of Agriculture, Hotel Lindum, St. Annes-on-Sea, Lancashire.

The Soap Makers' Directory, 1941, published by Messrs. Simpkin Marshall (1941), Ltd., includes all the usual features associated with it, though there is an increase in price by 1s. to 3s. 6d., and also a slight reduction of the number of pages compared with the edition for 1939.

Changes in the schedule of reserved occupations include new reservations in the wholesale drug trade, where head assemblers, supervisors, and checkers of dangerous drugs and poisons holding Home Office certificates are now reserved at the age of 35. Actually, only about 170 men engaged in these occupations are stated to be of military age.

Following discussions between the National Engineering and Allied Trades Employers' Association, and the Chemical Workers' Union, agreements have been signed arranging a basis of procedure for negotiations in the matter of Union members engaged on various chemical processes in engineering establishments.

The publication is announced, by Messrs. W. & G. Foyle, Ltd., 113-125 Charing Cross Road, London, W.C.2, of a new "Standard Chemical and Technical Dictionary." Priced at £3, with 638 pages, the dictionary contains, as well as a full series of definitions, a section of abbreviations and symbols and a list of prefix-names of organic radicals.

At a meeting of representatives of coke oven undertakings held in London recently arrangements were completed for the organisation of the industry with a view to ensuring the greatest possible help in the prosecution of the war. The British Hard Coke Association was formed, representing 98 per cent. of the total production of coke oven plants in the United Kingdom, and a committee has been appointed, with Mr. Ralph Alsop as chairman. Mr. Leslie O'Connor is the director of the association, and Mr. F. Greenwell secretary.

Control of the following chemicals has been transferred to the Miscellaneous Chemicals Control, 1 Chester Street, Grosvenor Place, London, S.W.1: Lactic acid and lactates; lithopone; phthalic anhydride and phthalates; maleic acid and anhydride. Applications for licences and all correspondence relating to these chemicals should be addressed as above. The transfer of responsibility for certain other chemicals was recorded in THE CHEMICAL AGE on August 30 (p. 121) and September 13 (p. 151).

Although the normal activities of the British Rubber Publicity Association have been curtailed owing to present conditions, we are glad to be able to record that the Association's advisory services are functioning as efficiently as ever and are ready to render assistance to interested inquirers. The Association is a non-trading body, closely associated with various research and other organisations, and representative of rubber planting interests. It has an extensive information bureau, trade-mark index, etc., and produces a number of gratuitous publications, which may be obtained on application to 1 Albert Mansions, Lansdowne Road, Croydon, Surrey.

The Industrial Court has decided that all men employed at the coke works and by-products plant in Co. Durham, belonging to the Brancepeth Gas and Coke (Straker and Love), Ltd., Durham, must be members of the National Union of Coke Men and By-Product Workers. The Court decided in favour of a claim by the Union that members of the Union should not be compelled to work with non-unionists. The firm objected to the application of the agreement to 25 key men who were not Union members, and stated that in view of the special nature of the work carried out by these men, special terms of employment had been offered to them. The men were at liberty to join a union, but none of them had expressed a wish to do so. The Court's decision comes into operation on October 22 and is for the duration of the war only.

Foreign News

A small mill for the production of tungsten on a commercial scale is to be built by the Consolidated Mining and Smelting Co. of Canada, Ltd., near Hazelton, on the Skeena River, Central British Columbia.

Considerable quantities of glue are consumed in India, but despite the availability of ample raw materials, local production of glue has been insignificant. Recently, however, a modern glue plant, with a capacity of half a ton daily, was established at Bombay.

Imports of ammonium carbonate into Brazil in 1940, amounting to 456 tons, were double the amounts received during the two preceding years, although the majority of the commodities comprising the chemical import trade were purchased from abroad in smaller amounts.

Warlike conditions in the Western Desert, states the Horticultural Section of the Egyptian Ministry of Agriculture, have made it impossible to gather the red squill (*Urginea maritima*), which grows there wild in quantity, and is effective as a rat-killing agent.

Mexico is importing approximately 35 metric tons of caustic soda daily, says the U.S. Department of Commerce, as considerable amounts are used in the manufacture of paper from cellulose. Only a negligible amount of caustic soda is produced in Mexico because of the lack of a domestic outlet for the by-product, chlorine.

The Canadian pulp and paper industry, according to recent reports, is to instal its second commercial pyrites furnace. The possibility of using pyrites as a substitute for sulphur has been investigated for more than 10 years, and in 1930 an experimental furnace was set up in the St. Maurice Valley of Quebec. These initial furnaces were not entirely successful and it is only in the last five or six years that an improved type has been produced.

The chemical works at Mazingarbe, between Béthune and Lens, which were heavily bombed by Blenheim aircraft on Wednesday last week, are most likely to have been the by-product plant of the Béthune Gas Company, engaged in the manufacture of coal-tar products, synthetic ammonia, etc. There appears to be another chemical factory at that ill-fated colliery village (already notorious in the last war) engaged in unspecified electrochemical production. Last war veterans may recollect that the coal mines there were worked at night throughout the duration of hostilities.

Forthcoming Events

A meeting of the **Society of Public Analysts** and Other Analytical Chemists will be held, at 3.45 p.m., on **October 1, at the** Chemical Society's Rooms, Burlington House, London, W.1. The following papers will be read and discussed: "The Determination of Traces of Mustard Gas in Contaminated Foodstuffs, etc.," by H. C. Lockwood, B.Sc., Ph.D., F.I.C.; and "A Rapid Method for the Determination of Terpinyl Acetate and other Esters," by Miss H. M. Perry, M.Sc., F.I.C., and T. F. West, M.Sc., Ph.D., F.I.C. Several chemists interested in war gas detection will exhibit pieces of apparatus, which may be of use in micro-analysis.

A meeting of the **Institute of Fuel** will be held in the Connaught Rooms, Great Queen Street, W.C.2, on **October 15,** at 2.30 p.m., when Lieut.-Col. Sir John Greenly, K.C.M.G., C.B.E., F.Inst.F., will instal Mr. W. M. Selvey, Wh.Sc., A.R.C.S., M.Inst.C.E., M.I.Mech.E., M.I.E.E., F.Inst.F., as President of the Institute for the coming year. After the installation, Mr. Selvey will give his presidential address entitled, "The Hundred Thousand: An Engineer's Philosophy." During the meeting the Melchett Medal for 1941 will be presented to Dr. Clarence A. Seyler, D.Sc., F.I.C., F.Inst.F., who will present the Melchett Lecture, entitled, "Recent Progress in Coal Petrology."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Satisfaction

WEST LANCASHIRE SAND & LIME CO., LTD., Southport. (M.S., 27/9/41.) Satisfaction, September 3, of mortgage. Registered July 1, 1939.

Company News

William Blythe & Co., Ltd., have declared an interim dividend of 5 per cent. (3 per cent.).

Aspro, Ltd., have announced a final dividend of 15 per cent. on the ordinary stock. With the interim of 10 per cent. already distributed, this brings the payment for the year to June 30, 1941, to 25 per cent. (same).

Benzol and By-Products, Ltd., have declared a further 3 per cent. dividend on the cumulative participating preference shares on account of arrears, for the six months ending September 30, 1930.

Sadler & Co., Ltd., have announced a dividend of 5 per cent. for the year (same). In December, 1940, a special cash distribution of 6¼ per cent., not subject to tax, was declared out of profits on sale of investments.

Oxley Engineering Co., Ltd., announce a net profit for the year to June 30, of £13,953 (£15,674), after providing £53,504 (£21,940) for taxation. The dividend for the year is raised from 10 to 12½ per cent., and £7025 (£7272) is carried forward. Meeting, Leeds, October 3, at 12.30 p.m.

New Companies Registered

Synthetic Supplies, Ltd. (369,495).—Private company. Capital, £500 in 500 shares of £1 each. Manufacturers of and dealers in cotton, wool, silk, hemp, jute, rubber, vulcanite, ebonite and similar synthetic substances, engineering equipment, chemicals, metals, lacquer, enamel, varnish, etc. Directors: F. H. Platt and Mrs. A. M. T. Platt. Registered office: St. George's College, St. George's Avenue, Northampton.

Prothoplastic Co., Ltd. (369,332).—Private company. Capital, £1000 in 1000 shares of £1 each. Wholesalers, retailers, distributors and manufacturers of dental, surgical and medical products, research and general chemists, druggists, manufacturers of and dealers in chemical, industrial and agricultural products, etc. Directors: W. T. Harris, 70 Upwood Road, S.E.12; J. R. Saunders.

Cavendish (Platings), Ltd. (369,353).—Private company. Capital, £1000 in 1000 shares of £1 each. Manufacturers of and dealers in chemicals, metals, nickel, lacquer, enamel, varnish, polish and plating materials, metal depositors and sprayers, electro-platers, etc. Subscribers: F. H. Platt (also director); Mrs. A. M. T. Platt. Registered office: Cavendish Engineering Works, Hartington Road, South Lambeth, London.

British Coal Oils Board, Ltd. (369,392).—Private company. Capital, £1000 in 1000 shares of £1 each. To purchase, sell, export, import and deal in all liquid and solid products obtained by the distillation or carbonisation of coal and other indigenous materials, to prepare and carry into effect a scheme for collecting and distributing such products, etc. Subscribers: B. A. Woolf; Beatrice E. Hardwick. Solicitors: B. A. Woolf & Co., 59a London Wall, E.C.2.

Hydrol Chemical Company, Ltd. (369,510).—Private company. Capital, £100 in 100 shares of £1 each. Emulsion specialists, manufacturers of and dealers in aqueous mineral oil emulsions, and soluble aqueous emulsions for use as lubricants, coolants and detergents, honing oils, synthetic resins, thermoplastic mouldings, petrol, motor spirit, etc. Directors: Horatio W. Hutton (permanent managing director); Mrs. Maud Hutton; Dorothy M. Hutton. Secretary: Frederick R. Hopkins, 9 Kings Bench Walk, E.C.4.

Chemical and Allied Stocks and Shares

THE volume of Stock Exchange business has remained at a lower level, and the majority of movements in values, although mostly small, have again been reactionary in character. At one time, however, the market tendency became firmer under the lead of British Funds, although the general attitude was cautious because for the time being the prevailing trend of markets may be governed almost entirely by the nature of the war news. There was, however, again very little selling, and the firmness with which all classes of securities continued to be held has maintained a steady undertone. The majority of shares of chemical and kindred companies were relatively steady, and despite the reactionary market conditions earlier in the week, movements on balance did not exceed more than a few pence. At 31s. 9d. Imperial Chemical were little changed, allowing for the deduction of the interim dividend from the price. The maintenance of the interim at 3 per cent. was in accordance with expectations, and the view prevails that there seem reasonable possibilities of a total of 8 per cent. again being paid for the year. On this basis the yield would work out at fully 5 per cent. at the current price. This exceeds the yields obtainable on many other leading industrial shares, which in some cases are little more than 4 per cent., and it would appear that I.C.I. ordinary are somewhat moderately valued in comparison. I.C.I. 7 per cent. preference units were quoted at 32s. 9d. B. Laporte were again 62s. 6d., and Fison Packard 33s. 9d., while elsewhere, business at 13s. 6d. was recorded in Burt, Boulton and Haywood ordinary shares. Borax Consolidated at 28s. 9d. were within 3d. of the price ruling a week ago. Lever and Unilever, although "ex" the dividend, were little changed at 26s. awaiting publication of the full results for the past year's working, while British Oil and Cake Mills preferred maintained a steady tendency around 40s. 6d.

Although best prices shown recently were not held, Dunlop Rubber were little changed on balance. British Oxygen went back to 66s. 3d., but British Aluminium were steady at 44s., following deduction of the half-yearly dividend from the price. British Match remained a steady feature at 34s. Imperial Smelting held their recent improvement to around 13s. and remained firmly held on hopes of better results for the past financial year. On the other hand, General Refractories had an easier tendency at 10s. 10½d. Although maintenance of the dividend at 20 per cent. continues to be expected in the market, Murex ordinary shares have moved back from 88s. 9d. to 87s. 6d. at the time of writing. Elsewhere, however, United Molasses remained steady at 27s. although the units of the Distillers Co. eased slightly to 69s. 6d.

In the iron and steel section, Allied Ironfounders were firm at 19s. 3d., but Stewarts and Lloyds were affected by the general trend on the Stock Exchange and eased to 47s. 3d. Tube Investments were 93s. 1½d. Associated Cement went back slightly to 56s. 3d., as did British Plaster Board to 16s. 6d. Staveley Coal and Iron were 45s. 3d., at which the yield is approximately 5¾ per cent. gross on the basis of last year's dividend of 6¼ per cent., tax free. The lower profits reported by the last-named company reflect the much increased weight of taxation. There has again been a fair amount of interest in Triplex Glass 10s. shares, which were firm at 25s. 4½d. The yield on the basis of last year's 10 per cent. dividend is small, but this is a conservative payment, and the assumption in the market is that there may be prospects of a further improvement in the dividend for the current financial year. Business at 6s. has been recorded in British Glues and Chemicals 4s. ordinary shares, while elsewhere, William Blythe 2s. shares also transferred at 6s. Lawes Chemical changed hands at 8s. 9d., and Blythe Colour 6 per cent. preference at 18s. 9d. There was again a fair amount of activity around 3s. in the 2s. ordinary shares of British Industrial Plastics. Morgan Crucible 5 per cent. second preference were dealt in around 21s. Boots Drug were little changed at 34s. 3d., and Southalls (Birmingham) were around 25s., while Beechams Pills 2s. 6d. deferred shares remained firm at 9s. 9d. Sangers and Timothy Whites were easier at 17s. and 21s. 7½d., respectively. Following a reaction, a better tendency developed in oil shares awaiting the various dividend decisions now impending.

Imports of calcium chloride into Brazil increased to a total of 566 metric tons in 1940 from 312 in 1939. The United States supplied about one-half of the total imports and shared in the expanded trade. Exports of calcium chloride from the United States to Brazil have advanced from 278,300 lb. in 1939 to 341,300 in 1940. Exports during the first quarter of 1941 were 25,800 lb.

Bauxite deposits at Inverell, N.S.W., although of comparatively low grade, are being carefully examined by a committee under Sir Colin Fraser (Commonwealth Director of Materials Supply) with a view to the establishment of an Australian aluminium industry. Published analyses of ore from this and other New South Wales fields show an alumina content varying from 25 to 68 per cent., with 2 to 39 per cent. ferric oxide, and 0.16 to 20 per cent. silica.

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